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CONTENTS.

The Official Preparations of Senega. By Bertha Mueller, Ph.D., Assistant Pharmacist at the German Hospital, Philadelphia, Pa. 241

Seasonal Variation in the Resistance of Guinea-pigs to Poisoning by Tincture of Aconite. By Charles C. Haskell, M.D., Medical College of Virginia, Richmond, Va. 255

Back to the Chemist's Shop. By C. Ferdinand Nelson, Associate Professor of Physiological Chemistry, University of Kansas, School of Pharmacy 260

State Board Examinations. By Robert L. Kingland, Member of Minnesota State Board of Pharmacy 263

Quarterly Review on the Advances in Materia Medica and Pharmacy. By John K. Thum, Ph.G., Pharmacist at the German Hospital, Philadelphia, Pa. 268

The Technical Production of Hydrogen and Its Industrial Applications. By Harry L. Barnitz, Ph.G. 284

Book Reviews 295

Current Literature: On the Presence of Histidine-like Substances in the Pituitary Gland (Posterior Lobe); Origin of the Buttermilk Cult; Tarantism and the Dancing Mania; Diabetic Foods; Tartrazine as a Food Color; Revision of the Pharmacopœia; Standard; Sanitary Condition of Bottled Waters; Thymol from Peppermint; Color-blindness 299

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THE AMERICAN
JOURNAL OF PHARMACY

JUNE, 1916

THE OFFICIAL PREPARATIONS OF SENEGA.

By BERTHA MUELLER, P.D., Assistant Pharmacist at the German Hospital, Philadelphia.

It has no doubt been the experience of many a pharmacist that the official preparations of Senega offer difficulty with regard to elegance and keeping quality.

The U. S. P. Fluidextract of Senega, in spite of its high alcohol content, is an unstable preparation. This is clearly demonstrated by the fact that if the freshly prepared fluidextract is neutralized until faintly alkaline, and set aside, it will be found that in the course of six months to a year from date it has again developed a strong acid reaction, is decidedly less acrid to the taste, reduces Fehling's Solution readily, has a marked methylsalicylate flavor, and will not mix clear with water. These changes are in all probability due to an enzyme present in the drug which causes the glucosidal principle, senegin, to be split up.

Research work has shown that if the crude drug is properly scalded with boiling water, allowed to stand tightly covered for about six hours, then dried in an oven at a moderate heat previous to extraction, these changes will not take place in the finished preparation. The scalding and drying process does not affect the drug in such a way as to make thorough and complete extraction difficult, for repeated biological tests have shown that a fluidextract prepared in this way is hemolytically just as active as a freshly prepared U. S. P. fluidextract is. Both preparations were hemolytically active in dilutions down to a 0.5 per cent. strength.

The present U. S. P. directions for neutralizing the fluidextract are not satisfactory, as the crude drug appears, from a number of samples worked with, to be very variable in acid content. It is therefore not advisable to direct a fixed quantity of alkali to be used for a

given quantity of fluidextract. In order to be more exact and not get the preparation either too alkaline or not alkaline enough, the amount of alkali required should, in each case, be calculated according to the acid content of the finished preparation. The most satisfactory way, with the least possible amount of time and labor required, is to make about 100 c.c. of a 1 per cent. aqueous solution of the fluidextract and titrate that with a potassium hydroxide solution of definite strength, preferably a 1–5000 solution, and from the findings calculate the amount of alkali required for proper neutralization. Phenolphthalein is used as indicator.

Considerable work was also done with menstruums of various alcoholic strength, and it was found that diluted alcohol makes quite as satisfactory a menstruum for extracting senega as the official menstruum is. A fluidextract prepared with diluted alcohol keeps just as well and is hemolytically just as active as a fluidextract prepared with the official menstruum. It also yields a rather nicer syrup (if one is content to make the syrup by merely mixing the fluidextract with simple syrup, which is, at best, a rather unsatisfactory method) than the stronger alcoholic preparation does, since there is less fixed oil present in that preparation than in a fluidextract made with a stronger alcoholic menstruum.

A very satisfactory fluidextract of senega may be prepared according to the following formula:

Senega in No. 30 powder	1000.0
Boiling water	2000.0
Diluted alcohol, a sufficient quantity to make	1000.0

Pour 2000 mils of boiling water upon the drug, mix well, cover up tightly and allow to stand from six to eight hours, then dry at a moderate heat, and exhaust the drug with diluted alcohol according to U. S. P. directions. Neutralize the finished preparation with potassium hydroxide solution until faintly alkaline.

The official Syrup of Senega, prepared by simply mixing the fluidextract with syrup is, likewise, a rather unsatisfactory preparation. Within twenty-four hours after it has been made it becomes cloudy and in time stringy, which naturally makes it a very unsightly preparation. Considerable work has been done in trying to prepare a satisfactory syrup directly from the crude drug, but the several formulas that had been advanced and tried out proved quite unsatisfactory. All the samples prepared directly from the crude drug became cloudy and unsightly within three to six months from date,

and some samples about a year old had completely gelatinized so that the syrup could not be poured out of the bottle.

A really satisfactory preparation can, however, be made according to the following formula:

Fluidextract of senega	200.0
Sugar	850.0
Purified talc	15.0
Distilled water to make	1000.0

Dilute the fluidextract of senega with 400 mils of water; if acid in reaction, neutralize with potassium hydroxide solution until faintly alkaline. Allow to stand from six to twelve hours, filter through purified talc, and percolate the filtrate through sugar.

This syrup, on biological test, proved to be hemolytically just as active as the syrup prepared according to the U. S. P. method. It is a beautifully clear preparation and remains so for a long time. We have some samples on hand made nearly two years ago that look just as nice and clear as they did when freshly made.

SEASONAL VARIATION IN THE RESISTANCE OF GUINEA-PIGS TO POISONING BY TINCTURE OF ACONITE.

By Charles C. Haskell, M.D.

It has been shown that the chemical assay method for aconite preparations is not to be relied upon.[1, 2, 3, 4] Such being the case, it is important to scrutinize carefully the various physiological methods that have been proposed and endeavor to ascertain which is the most desirable. The attempt has been made in previous papers to show that this scrutiny should be directed chiefly to two methods: the guinea-pig method and the cat method.[5, 6]

The guinea-pig method, proposed originally by Reed and Vanderkleed,[7] has much to recommend it. Guinea-pigs are usually easy to secure and can be kept with little trouble. The technic of the test is very simple, and it can be carried out by a single operator without assistance. Individual variation is not marked, it being unusual for pigs to die "out of order," to use the expression of Vanderkleed. The cat method of Hatcher, on the contrary, necessitates the securing of animals which are, apparently, scarce in certain localities. The cats are prone to develop disease when kept confined for long periods

of time; the technic of the test is difficult for the inexperienced; and considerable individual variations are frequently encountered. It has been found, however, that the resistance of guinea-pigs to poisoning by ouabain [8] and by other toxic agents [9] is influenced by season, and it is of importance to ascertain whether the resistance of these animals to poisoning by aconite is not subject to the same seasonal influence.

In October, 1915, a number of samples of tincture of aconite were tested in our laboratory by the guinea-pig and by the cat methods. In order to learn whether the resistance of the pigs to aconite poisoning was independent of season, one of the samples was kept in the original pint bottle and was tested each month since then by determination of the lethal dose for guinea-pigs. The results obtained are given below:

TABLE I

Date	Dose in cc. per gramme body weight	Result
October, 1915	0.009	Survived.
	0.010	Survived.
	0.012	Survived.
	0.014	Survived.
	0.015	Died.
November, 1915	0.012	Survived.
	0.015	Died.
December, 1915	0.010	Survived.
	0.015	Died.
January, 1916	0.010	Survived.
	0.012	Survived.
	0.015	Died.
February, 1916	0.010	Survived.
	0.012	Survived.
	0.015	Died.
March, 1916	0.010	Survived.
	0.012	Died.
	0.015	Died.
April, 1916	0.010	Survived.
	0.010	Survived.
	0.010	Died.
	0.010	Died.
	0.011	Died.
	0.011	Died.
	0.012	Died.

From this table it is evident that no marked variation in the resistance of the animals was present during the months of October,

November, December, 1915, and January and February, 1916. In March of 1916, however, a pig succumbed to a dose of 0.012; in the succeeding month, the dose of 0.010 was fatal to three out of the five pigs receiving it; while larger doses than this were invariably fatal.

Liquid galenical preparations that undergo any change on standing generally lose strength. The bottle in which the sample used in these tests was kept was frequently opened, and the possibility exists that evaporation of the menstruum occurred, leaving the aconitine in a more concentrated solution. Fortunately, however, the sample was assayed in November, 1915, by Hatcher's cat method. The results of this assay, carried out on male cats, is given in Table II.

TABLE II.

No.	Weight in grammes	Lethal dose in cc. per gramme body weight
1	3260	0.00981
2	2500	0.00880
3	3010	0.00850
	Average...0.00903	

On April 15th and April 17th, this sample was again tested on male cats, with the following results:

TABLE III.

No.	Weight in grammes	Lethal dose in cc. per gramme body weight
1	2950	0.0102
2	3245	0.0123
3	2852	0.0111
4	2875	0.0111
5	3080	0.0111
	Average...0.01116	

It would seem, from this second assay by the cat method, that the tincture has not become more toxic, but has, apparently, deteriorated a not inconsiderable amount; the average lethal dose in April, 1916, being more than twenty per cent. larger than the dose determined in November, 1915. It is scarcely probable that the

resistance of the cats is greater in the latter month, though the possibility exists.

The following conclusions seem justified:

1. The guinea-pig method as carried out at the present time is unreliable, because it has been shown that season influences in a decided way the resistance of the animals to poisoning by tincture of aconite.

2. The cat method of Hatcher for the assay of aconite is worthy of a more extended trial. From the results obtained with this method in testing digitalis it is improbable that seasonal influences play much of a rôle in influencing the resistance of the animals.

Laboratory of Pharmacology, Medical College of Virginia,
Richmond, Va.

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[5] AMERICAN JOURNAL OF PHARMACY, lxxxviii, No. 1, Jan., 1916, p. 3.
[6] *Ibid.*, Nov., 1915, p. 489.
[7] *Ibid.*, lxxx, p. 110.
[8] *Ibid.*, lxxxiv, No. 6, p. 241.
[9] Bull. 69, U. S. P. H. and M. H. Service.

BACK TO THE CHEMIST'S SHOP.

By C. FERDINAND NELSON, Associate Professor of Physiological Chemistry, University of Kansas, School of Pharmacy.

There is something eminently proper, dignified, and altogether fitting in calling a drug store by its English title—The Chemist's Shop. That is precisely what it should be, but sadly enough in America to-day, seldom is. When we speak of the chemist's shop, it immediately calls to mind the many struggles, trials, and hosts of associations of the past. It explains, in a measure at least, our evolution as a distinct group of men devoted to a definite calling. It shows also very clearly how intimately pharmacy and chemistry have always been associated with each other and how the two have gone hand in hand until recent years, when, with the tremendous accumulation of chemical data in numerous fields not directly asso-

ciated with medicine, it has become a profession of its own already highly specialized and divided. Historically the pharmacist has a good right to be called a chemist; logically and practically that is precisely what he ought to be, at least in part, and in this capacity he should serve the community in which he lives and labors. The pity of it is that instead of anchoring ourselves to the past, and from this sure point of vantage advance into the future, we are setting out upon a sea of pure commercialism, going we know not whither, and entirely forgetting our true place and function as professional men.

But let us ask, can the pharmacist of to-day afford to let go of this rich heritage of the past? Should he sever all real connection with things chemical and devote himself entirely to other fields of endeavor? Is it desirable that the extreme commercialism which has already made such destructive inroads upon our retail drug practice should continue? Evolution implies growth; advancement means progress. We cannot stand still; we must either grow or decay. And there are few of us who will not be forced to admit, if we be honest with ourselves, that however keen and progressive we may be as men of business, we are miserably lacking when it comes to professional strength and development. If we would continue, therefore, to call ourselves pharmacists and professional men, we must begin a radical improvement in our methods and practice.

Many pharmacists have for years cherished as an ideal the idea of operating a drug store in which only physicians' prescriptions were compounded. It is reasoned thus: "If we could only get rid of the side lines, such as patent medicines, cigars, sundries, and the like, with which we are now burdened, but which we find absolutely necessary to keep us alive, how happy we would be. Then could we be real pharmacists. This is the goal for which we would strive." The real drug store, they would say, is the one that only compounds physicians' prescriptions and sells drugs. To them to be a prescription compounder covers all that the word pharmacist implies. Here they reach their goal; their professional ambitions are satisfied.

That this point of view is better than a purely commercialistic one is undoubtedly true; and yet we have all of us witnessed many pharmacists failing miserably because of their inability to secure an adequate patronage when attempting to conduct their business purely along these lines. A pure prescription business is undoubtedly desirable, and yet when all is said, to be only a compounder of drugs must not be the only aim of the pharmacist nor must this occupy

all of his time and energy. The pharmacist who, in the future, decides to establish a business of this sort, ignoring all else, will probably meet the same fate that his brother pharmacist has in the past. If an exclusive prescription business has been impossible in the majority of instances in the past, the changing conditions of the present make a similar attempt to-day harder than ever to realize. *We must not ignore the fact that the profession of medicine is marching onward at a tremendous rate, and that the practices which pertained yesterday do not hold at all to-day.* When I was an apprentice in pharmacy, twenty odd years ago, every prescription that came into the store usually consisted of mixtures of four, six or eight ingredients. I well remember hearing my employer say this or that physician who did not prescribe a vast, complex mixture did not know very much. He was a poor doctor or he would have written a more complex prescription. But witness the change. Every year that goes by finds a decrease in the number of drugs used. Prophylactic medicine is taking its hold. We are curing diseases nowadays by keeping our bodies fit, by proper food, by pure air, by mental suggestion. The pharmacist cannot fill these prescriptions, and so the old idea of an exclusive prescription store, however desirable it may have been, must be abandoned.

To say this does not mean to say that the physician will cease to write prescriptions. On the other hand it seems rather safe to say that as the educational requirements and professional training of the physician increase, he will progressively abandon dispensing his own medicine, as he now often does, and leave that work to the pharmacist. There will thus be more prescriptions written by different men, but in all probability each man will not write as many prescriptions as he formerly did. Physicians will not be as elaborate in the number of ingredients and variety of drugs used. There will be no need of carrying a huge stock of pressed herbs for making infusions, an endless assortment of plasters and salves, hundreds and hundreds of pills, fluidextracts, elixirs, and syrups. There will rather be a few drugs of recognized value whose strength will be carefully standardized and whose action, well known. These it will be the duty of the pharmacist to dispense.

And again, the preparation of the few drugs the physician will use will in all probability be best carried out by the large first-class pharmaceutical houses now in existence, who have every facility for collecting, preparing, examining, and properly checking the raw and

finished products, which the retail pharmacist with his little store possibly cannot have. And there should be no difficulty for us in accepting this point of view. We should not be so loath to stop making a few galenical preparations which we have heretofore considered as a mark of our professionalism. If we but consider, we will remember that one-half to three-fourths of the drugs we have always used have been made, not in our own stores, but in the larger manufacturing establishments. For example, few pharmacists have ever felt that they should make their own pepsin, pancreatin, or oil of wintergreen. Why, then, should we care if the percolators in the back rooms of our stores are not turning out a few such simple preparations as tr. arnica, tr. opium, or fluidextract or sarsaparilla? To be sure, the prospective pharmacist should be taught how these preparations are made and actually to make them in his preliminary college training, just as he should also be instructed concerning all the known drugs in the materia medica, whether they are for the moment in actual use or not. But in his actual retail practice, he can well afford to abandon this time-consuming and not particularly skilful work and devote himself to the chemical and pharmacological examination of the finished products he buys. As prescription specialist, he should rather serve his customer by guaranteeing the strength and reliability of the few ingredients he puts into the prescriptions that he compounds, that incompatibilities are avoided, and that the dose is safe and accurate.

Where, then, you will say, is our field? If we cannot hope to do an exclusive prescription business, if we must even abandon the preparation of the drugs we use in our prescriptions to manufacturing houses, are we not doing the eminently proper thing by increasing our side lines, by changing to the opposite extreme and becoming purely commercial in our methods? No! a thousand times, No. Let us rather shift our point of view; adjust ourselves to the conditions we find ourselves in; abandon some of the ideals we have had, and in their place adopt newer, better, and larger ones.

The young man who has graduated from a first-class school of pharmacy has received, in addition to his training in botany, pharmacognosy, materia medica, prescription compounding, and galenical preparations, a good training in inorganic and organic chemistry, in qualitative and quantitative analysis. He may, especially if he has elected a three- or a four-year course, even have taken one or two courses in drug analysis, bacteriology, food analysis, sanitary and

water analysis. On the whole he has a more thorough training in these subjects than the physician has. He is really better fitted, therefore, to undertake analytical work along chemical and bacteriological lines than the physician, who has to devote his energies chiefly to surgery and diagnosis. Now, if the practice of medicine is becoming more simple, so far as the administration of drugs is concerned, it is becoming ten times more complex and elaborate as regards chemical and bacteriological examination of body fluids for the purpose of diagnosis. These absolute checks are increasingly being demanded by the physician who, in anticipating disease, will advise his patients that analyses of this sort be made at regular intervals rather than wait until they are actually stricken. Beginnings of this sort are seen even now in our large cities, where certain physicians are devoting themselves to doing analytical work for their colleagues rather than entering into regular practice for themselves. *The modern pharmacist could and should do this work.* He has the better chemical training, has a large store which he can use for a laboratory, has an abundant stock of chemicals and other supplies which are needed for carrying on this work. All he needs to do is to familiarize himself with the special technique of these methods, which is easily done, granting that he has the preliminary training we have spoken of. The physician, moreover, will welcome a departure of this sort on the part of the pharmacist, because he has not the time or the energy to keep adequately informed on the details of this work and would gladly turn it over to the pharmacist, did he but know that he would handle it. There is a vast amount of this diagnostic laboratory work, which awaits but the proper men to do it. Suppose, now, that the pharmacist did devote himself along these lines. Suppose he established a department of this sort in connection with his retail practice. He could, in a short while, if he gave it proper attention, abandon selling many of the sundries which he has no interest or desire to sell. He could devote himself to this work and in addition maintain his prescription department, and this combination would give him ample field for all of his energy and in addition make him a truly professional man. To make the statements that I have made specific, I have drawn up the following list, which includes some of the analyses physicians might desire to have made in relation to their work in diagnosis. The beginnings made along these lines could be slow and modest, and as the business developed, the field could be enlarged.

Detection of tubercle bacilli in sputum.
Detection of diphtheria bacilli from throat swab.
Detection of malarial parasites.
Counting of red blood-corpuscles.
Counting of white blood-corpuscles.
Differential blood-count.
Per cent. of hemoglobin.
Widal test for typhoid fever.
Wassermann test for syphilis.
Complement-fixation test for gonorrhœa.
Examination of smears for gonorrhœa.
Identification of blood-stains.
Preparation of autogenous vaccines.
Preparation of sterile bandages, sterile water, and other solutions, syringes, needles, etc.
Examination of milk.
    Specific gravity.
    Reaction.
    Total protein.
    Casein.
    Fat.
    Milk-sugar.
    Detection of preservatives.
        (1) Sodium carbonate.
        (2) Salicylic acid.
        (3) Formaldehyde.
        (4) Boric acid and borax.
Hydrogen-ion concentration of urine and fæces.
Examination of gastric contents.
    Detection of free hydrochloric acid.
    Detection of butyric acid.
    Detection of acetic acid.
    Detection of pepsin.
    Detection of rennin.
    Detection of protein digestion products.
    Detection of carbohydrate digestion products.
Quantitative determination.
    (1) Of total acidity.
    (2) Free acidity.
    (3) Combined acidity.
    (4) Acidity due to organic acids and acid salts.

Urine.

Qualitative examination.

Specific gravity and reaction.
Albumin.
Sugar.
Acetone.
Diacetic acid.
Indican.

Quantitative determinations.

Total nitrogen (Kjeldahl).
Urea (Van Slyke's Urease Method).
Uric acid (Folin's microchemical method).
Chlorides.
Dextrose (Benedict's method).
Albumin (Folin's turbidimetric method).

There is but one drawback to our entering this profitable phase of truly professional work and that, I am sure, is none other than the pharmacist's tremendous inertia and lack of confidence when dealing with things professional, his phobia of not daring to proceed along these lines from the known to the unknown without some one to show him exactly what ought to be done and how to do it.

The work mentioned above refers only to a few of the diagnostic methods which the physician requires. But the pharmacist's possibilities in chemical and bacteriological work, if he once enters upon this field, do not by any means end here. He may, for example, in addition devote himself to the analysis of foods and food products, milk, cream, cooking oils, fats, meats, candies, flavoring extracts—all commodities, in fact, which are used as foods, or he may make sanitary water analyses, gas analyses, iron and steel analyses, the various analyses required of him in his capacity as city chemist. The field is limited only by the energies which he chooses to put forth. *Why can we not, as a profession, begin, at least in a small measure, to abandon the selling of soda-water, cigars, sundries, paints, and ham sandwiches, for this more skilful, and more truly professional work?* Our preliminary training has been all along these lines. Why should we not make some use of the information we have spent so long a time acquiring? It is granted that the beginnings will be hard, but that should make us all the more eager to attempt them.

STATE BOARD EXAMINATIONS.*

By ROBERT L. MORLAND, Member of the Minnesota State Board of Pharmacy.

It has often been the subject of comment and inquiry that so many candidates fail in the examinations conducted by our Board. There are various reasons for these failures. The Board arranges its examinations with the greatest possible care, and spends more time in conducting them and marking the results than probably any other board in the country. It endeavors, so far as possible, to avoid questions which necessitate memorizing abstract facts of no particular value, and avoids difficult prescriptions and incompatible preparations. But it is very difficult for a board to frame questions and assign practical work that will fit the mental capacity and mechanical ability of the majority of the candidates who appear before it, unless such board considers its work merely a perfunctory duty, to be disposed of in the easiest manner and in the least possible time.

The prevailing thought among the candidates of to-day seems to be to get through every task with the least possible exertion; and, therefore, it is impossible for these to show even fair knowledge or skill in pharmacy in the length of time they devote to the study of it and the manner in which they use their time.

The idea seems to be general that a thorough knowledge of pharmacy may be obtained by the average student after four years' experience in a modern drug store, or two years in such and two years in a school of pharmacy. Such a feat is not impossible, but the students who would burn the amount of midnight oil necessary to its accomplishment are comparatively few.

The young people of to-day, as a class, are not studious; they are pleasure-loving. At school, college, and university they waste a great deal of valuable time in outside activities and social enjoyments, and "cram" for examinations.

I am a firm believer in a proper amount of recreation and social enjoyment, but these should never be allowed to interfere to any serious extent with the course of study. There are, of course, in every school some who can devote a great deal of time to matters outside of the prescribed course and still keep their work up to a high level, but the majority cannot do this. When those who have

* Read before the Scientific Section of the Minnesota State Pharmaceutical Association, Minneapolis, February 9, 1916.

wasted valuable time in one way or another appear as candidates before a quasi judicial body, such as a Board of Pharmacy, and are given examinations to determine how much of their education has been retained and how much has filtered through, then we hear complaints of the unfairness of some of the questions, the difficulty of the examinations as a whole, or the objectionable personalities of the examiners as excuses for ignorance, carelessness, or both combined.

In case you may think these strictures too severe, let me give you a few answers, taken at random, from recent examination papers:

"Rhizomes are Mediterranean stems which grow underground."

"Pilocarpus is broom tops."

"Phenol is obtained from the destructive distillation of wood."

"The source of phenol is the mines of Germany."

"Pepsin is taken from the inside of a hog; the pancreas is taken out and dried and kept in air-tight bottles."

"Pancreatin is taken from the calf. It is prepared in nearly the same manner as pepsin."

These last two answers are by the same candidate.

"A fixed oil is an oil that is made by distillation or other process, and an essential oil is an oil made artificially by dissolving in an alcoholic solution, such as perfumes, etc."

"State source of paraffin." Answer: "From the whale."

"Pepsin is found in the lining of the abdomen of the hog."

These last two answers are from graduates in pharmacy.

"Pepsin is found in the bile of a sheep. Pancreatin is from the fat of a hog. Pancreatin is obtained from hops or barley. Linseed oil is obtained from the cotton seed."

All of these are answers from the written portion of the examinations.

Now let me give you a few examples of how the practical work was done. Every candidate is compelled to bring with him a copy of the U. S. P. and N. F., and they have these books before them in all practical work.

"Prepare one dozen compound cathartic pills," was one of the instructions given at the last examination. The completed pills varied in weight from 22½ to 80 grains. Another example was: "Prepare six Seidlitz powders." Many of the candidates did not weigh the powders, but divided them by eye, with the result that the blue papers varied in weight in the same half dozen from 16 to 53 grains. Several of those who weighed the powders had differences

of from 15 to 30 grains, and in one case 9 grains difference in the white papers. This set of Seidlitz powders, which I now present for your inspection, was made by a candidate who has had three years' experience in a drug store, but has never attended a school of pharmacy. He thought he had a good chance to become a registered assistant by examination. He had never seen the inside of a Seidlitz powder. He had never sold one except in the original wrapped packages bought from the manufacturer. The blue papers contain about 1½ grains each and the white ½ grain.

A prescription for an ointment was presented containing one drachm of mercury and two drachms of wool fat. One candidate turned in 4 drachms and 18 grains of finished product, another three drachms and 38 grains, and in both cases a considerable quantity was left in the mortars.

Another candidate asked for and obtained nitric acid to extinguish the mercury before adding the wool fat. Another used 1 drachm of mercuric iodide (which had been supplied for making Donovan's solution) instead of mercury.

At an examination some time ago a candidate was asked to make 12 pills of aloin, strychnine, and belladonna. He took the quantity for 100 pills and divided it into 12. Scores of examples similar to the above could be taken from the results of every examination, but I think I have given enough to account for the percentage of failures being as great as it is.

Such answers show ignorance, carelessness, and lack of reasoning power, yet all of the candidates who wrote these and did the practical work just mentioned believed themselves qualified to act as pharmacists or assistant pharmacists.

What is most needed to raise the percentage of success in our examinations is to rid ourselves of the idea that a knowledge of pharmacy sufficient to entitle a person to practise it with safety to the public can be obtained in a " catch-as-catch-can " manner. It cannot be obtained by simply putting in the prescribed time in the average drug store without systematic study, or by merely attending classes in a school or college of pharmacy. Pharmacy to-day is more complex than ever. The old order of things has changed. New drugs are being used and more complex preparations are in vogue than ever before. The standards of quality for all drugs are being raised, and the tests for purity increased. The pharmacist of to-day is expected, and rightly so, to be able to determine the quality and purity of the

substances he uses; thus the demands made upon the student of pharmacy are constantly increasing and more time and study are required than ever before to meet modern conditions—probably more, you may say, than the remuneration of the calling warrants; but that is the fault of business conditions, not of the practice of pharmacy.

QUARTERLY REVIEW ON THE ADVANCES IN MATERIA MEDICA AND PHARMACY.

By JOHN K. THUM, PH.G., Pharmacist at the German Hospital, Philadelphia, Pa.

Higher prices for drugs and chemicals still obtain all along the line, and there seems to be no likelihood of any breaks in that line in the near future. Naturally, a situation like this engenders more or less comment from every one. Indeed, very few escape being affected by this unprecedented era of high prices, which not only obtains in our calling, but exists in all spheres of business activity.

Editors of lay journals, newspapers, and magazines, to say nothing of pharmaceutical journals, appear to be almost unanimous in the opinion that this era of higher prices is to remain with us for some time. Some assert that the ending of the war will not mean an ending of this upward tendency of prices, and one is so bold as to say that after the war, instead of a reduction in the prices of commodities, prices will be still further advanced. From the standpoint of the buyer this is indeed pessimism! We are unable to agree with this view of the situation. After the cessation of hostilities there will be a large number of men return to work; labor, both skilled and unskilled, will be cheap as compared to the present or even pre-war times, and in this country the vast number of men who have been engaged in the manufacture of war material will return to, or at least be available to engage in, the manufacture of things of a more pacific nature. It must also be remembered that at the close of the war the present embargoes maintained by nearly all of the belligerents will be raised; and surely this must also prove something of a factor in bringing the cost of at least drugs and chemicals to something near their former prices.

The experiences that the people of this country are going through

while this terrible war is in progress certainly must prove a stimulus and an aid to the development of the potential resources and latent genius that this nation undoubtedly possesses.

The department of " Therapeutics " in the *Journal of the American Medical Association* often contains information and comments about advances made in medicine that should be, and are, of interest to pharmacists. In the last few years much has been written about the cardiac tonics, particularly digitalis and, to some extent, strophanthus. Any new facts that are brought out concerning these drugs, and preparations of these drugs, that are backed up by animal experimentation must appeal to the conscientious physician and should, of necessity, be of interest to the wide-awake pharmacist. Much of this work has been done by Hatcher and Eggleston. Concerning some of their more recent work " Therapeutics " has this to say, and, as we are just now passing through a period of " fat-free " digitalis agitation which hits the medical profession every now and then, this comment is peculiarly appropriate:

" Several years ago Hatcher and Eggleston investigated the emetic action of digitalis. Their results showed that the digitalis bodies produce nausea and vomiting through action on the vomiting centre in the medulla. The direct action of therapeutic doses of these drugs on the gastric mucous membrane is unimportant. The fixed oil or fat from digitalis, to which the emetic properties are sometimes attributed, was given to cats in large doses without producing any symptoms whatever. It is clear, therefore, that efforts to avoid nausea by removal of the oil, administration through other channels than the stomach, or any other means than regulation of the dose must prove unavailing. It might naturally have been expected that the same conclusions would apply to strophanthus preparations, especially as no satisfactory evidence has been presented in support of the claim that the oil present in tincture of strophanthus helps to produce the nausea which sometimes occurs after its use. Hatcher has performed experiments with oil of strophanthus which show that this assumption is justified. He finds that the average therapeutic dose of the tincture of strophanthus contains less than one ten-thousandth part of that required to produce nausea and vomiting in the cat, relative to the weight. While removal of the oil renders the tincture more ' elegant ' pharmaceutically, such removal is of no therapeutic importance." (*Jour. A. M. A.*, April 15, 1916, p. 1199.)

THE STANDARDIZATION OF DIGITALIS AND THE POTENCY OF AMERICAN-GROWN DIGITALIS.—A comparison of American-grown digitalis leaves with those obtained from other sources showed that it is possible to grow leaves of a very high quality in this country. This was proved by biological determination. The experimenters worked with an infusion of the leaves and used Hatcher's "cat" method of standardization in preference to the so-called "frog" method. In their opinion, the latter method is less reliable than the former. It will be remembered that the "cat" method is comparatively simple and consists in determining the minimal fatal dose per kilogramme weight of cat, the drug being injected slowly into the femoral vein. They agree with Hatcher that the infusion does not deteriorate as rapidly as commonly believed; they also make the statement that there are differences in activity due to the method of preparation; they also believe that we have in America a digitalis that cannot be surpassed. They also make the statement that "the name of this or that firm does not always insure potency or digitalis effect." Altogether this is a most valuable paper and a distinct contribution to the positive knowledge concerning digitalis that is gradually being added to the literature of this well-known drug. (*Jour. A. M. A.*, March 18, 1916, by L. G. Rowntree, M.D., and D. I. Macht, M.D.)

DIGITALIS STANDARDIZATION. THE PHYSIOLOGICAL EVALUATION OF FAT-FREE DIGITALIS AND COMMERCIAL DIGITALIN.—In an endeavor to discover the activity of some commercial preparations of fat-free digitalis and German digitalin the following conclusions were drawn: The biological determination was carried out by the one-hour frog method. This method was selected because it is generally conceded that the various factors which must be considered in this method of assay are kept uniform. Absorption from the lymph system of the frog was found to be variable and to depend somewhat on the temperature at which the frogs were kept while assayed. A variation of over 250 per cent. was discovered in 13 samples of commercial fat-free digitalis and 150 per cent. in five samples of commercial digitalin (German). There is no difference in the qualitative effects of fat-free digitalis on the dog as compared to those produced by the official tincture; and the difference in the absorption between these two different tinctures from the lymph system of the frog is so slight as to be unworthy of notice. Some of the samples of fat-free digitalis showed considerable deterioration

after being kept under ordinary conditions for a period of from five to seven months. It is suggested that manufacturers adopt a uniform method of assay and a standard of activity. Only thus can physicians get uniformity, which they have a right to expect when they prescribe commercial preparations of digitalis. In view of the rapid deterioration of commercial preparations of fat-free digitalis it is deemed advisable that such preparations be dated, so that physicians have some means of knowing how old a preparation they are prescribing for their patients. (*Hygienic Laboratory Bulletin* No. 102, by George B. Roth, M.D.)

FEDERAL STANDARDS FOR MINERAL WATERS.—In no other country in the whole world is there such a large sale and consumption of mineral waters as in these United States. Recognizing this fact and the belief that the public has, generally speaking, of taking the purity of these waters for granted, the government has, through the activity of the Public Health Service, adopted the following standards. The authorities believe that these requirements are not too stringent to apply to waters that are imported from abroad.

1. The total number of bacteria developing on standard agar plates, incubated 24 hours at 70° C., shall not exceed 100 per cubic centimetre; provided that the estimate shall be made from not less than two plates, showing such numbers and distribution of colonies as to indicate that the estimate is reliable and accurate.

2. Not more than one out of five 10-mil portions of any sample examined shall show the presence of organisms of the *Bacillus coli* group.

It seems that the Bureau of Chemistry has been giving this matter of the purity of these waters considerable investigation for some years, and the above standards are the result of its investigations. Thus mineral and table waters that are offered for sale in interstate commerce are required to conform to these standards, and those of the public who are wont to use these things are guaranteed some measure of protection against careless and unhygienic handling of these waters by those who bottle them.

HISTORICAL REVIEW OF SOAP MANUFACTURING.—In this contribution much interesting information is given concerning an industry the products of which are used by all civilized peoples. The author briefly traces the history of this ancient industry from biblical times down to the present time of manufacture, when all the resources of the latest scientific knowledge are utilized in this interesting and

necessary industry. An experience of over forty years in the manufacture of soap is also drawn upon by the author in presenting this interesting paper. The statement is made that soap has been found by bacteriologists to be strongly antiseptic and disinfectant. It may also be of interest to know that at the meeting of the International Congress of Zoologists in 1907 a paper was read in which the writer made it clear that the "insecticidal value of soap is very considerable." Taking it all in all, this brief paper contains much that the retail pharmacist should know. In 1909 the soap made in this country was valued at $111,357,777, and the number of persons engaged in the manufacture was 18,000; this will give some idea of the magnitude of this business. (*Jour. of A. Ph. A.*, March, 1916, p. 295, by Joseph Abraham.)

Loss of Weight of Musk.—It is stated that when dry musk is exposed to a current of dry air for about seven months it loses weight, and when the loss of weight ends the musk is without odor. Furthermore, the odor is not restored by exposure to damp air. (*Jour. of The Franklin Institute.*)

Hexophan.—Used in the treatment of gout and rheumatism and is said to be oxyphenylchinoline-dicarbonic acid ($C_{17}H_{11}NO_5H_2O$), and to be made by the condensation of acetylsalicylic acid and isatine, which are heated together in an alkaline solution. The oxyphenylchinoline-dicarbonic acid obtained is purified by conversion into the sodium salt or the methyl ester. It is a yellow powder, without smell or taste, nearly insoluble in water, alcohol, and ether, and in warm hydrochloric acid, but soluble in ammonia and solution of sodium hydroxide. (*The Chemist and Druggist,* March 18, 1916, p. 40.)

Tests for Gum Acacia.—A publication of the United States Bureau of Standards contains interesting data concerning many of the published tests for acacia and gives descriptions of efforts to find others. It is said that basic lead acetate gives the most characteristic reaction, while solutions of copper and sodium hydroxide and of neutral ferric chloride and alcohol are of value as confirmatory tests. A summary is given of the more important methods that have been proposed for the quantitative estimation of gum arabic, followed by a description of the steps that led the investigators at the Bureau to the use of alcoholic copper acetate-ammonia solution for this determination. Dextrin and ghatti gum were also subjected to the same tests.

MEDICAL, SCIENTIFIC, EDUCATIONAL AND PHILANTHROPIC INSTITUTIONS NOT TO BE AFFECTED BY FIXED PRICE LEGISLATION.—Senator Ashurst, of Arizona, has introduced a bill into the Senate which provides that a grower, producer, manufacturer, or owner of an article having a trade-mark or special brand, who sells it to a dealer or retailer, can designate and prescribe the price at which it shall be resold, the object, of course, being to prevent the cutting of prices. In this bill, however, it is expressly provided that the act shall not apply in cases of sales of such articles to any society or institution established solely for educational, medical, scientific, or philanthropic purposes. (*Jour. A. M. A.*, March 25, 1916, p. 67.)

MAGNESIUM HYPOCHLORITE AS A DISINFECTANT.—The advantages claimed for this chemical over other hypochlorites as a disinfectant and germicide are that it is more powerful as a disinfectant and at the same time less caustic. It is also much cheaper; other things being equal, this is a desideratum not to be ignored. It is prepared for use by dissolving 190 grammes of magnesium sulphate in 2 litres of water and mixing this with 2 litres of water into which 100 grammes of chlorinated lime have been well stirred. The two solutions are first filtered before mixing; the resulting precipitate is allowed to subside and the clear supernatant liquid, preferably filtered, is then ready for use. This can be used freely as a dressing, as it has no untoward action on the healthy tissues. It is asserted that the organism bears the magnesium well—in fact, much better than can be said of either lime or sodium. (*Jour. A. M. A.*, March 25, 1916, from the *Paris Médicale*, Feb. 19, vi, No. 8, p. 197, by C. Mayer.)

THE THERAPEUTIC VALUE OF THE HYPOPHOSPHITES.—In order to be classed as a useful drug it is necessary that a drug be able to accomplish one of three things: (1) It must have either a local or a physiological action; (2) it must show a particular influence on pathological processes, and (3) it must have food value. After a brief review of the literature pertaining to the hypophosphites the writer of this paper adduces evidence, both of a clinical nature and the study of the effect, or lack of effect, of this drug on animals. The conclusions are that the hypophosphites as a source of phosphorus for the body are without value. No evidence is adduced showing that they have any physiologic effect; that they have any influence on pathologic processes; that they have any value as a food. The

author tersely adds: "If they are of any use, that use has never been discovered." (*Jour. A. M. A.*, Feb. 12, 1916, p. 488, by W. McKim Marriott, M.D.)

LABORATORY NOTES ON COLOR TESTS.—The following is submitted as a reliable test for the identification of caramel in flavoring extracts:

Tannic acid	1.00
Sulphuric acid	0.75
Water to make	50.00

The tannic acid is dissolved in 30 mils of water, the H_2SO_4 is added, and, after the precipitate which is formed is dissolved, the quantity is made up to the required weight. This solution is useful in detecting caramel in many things, such as whisky, brandy, flavoring extracts, ready-made medicines, and vinegar. The method of applying the test is as follows: To the suspected liquid (5 mils) an equal amount of the test solution is added; the mixture is slightly heated and allowed to stand 24 hours; at the end of that time, if caramel be present, a dark-colored precipitate will be present. (*Jour. A. Ph. A.*, March, 1916, p. 294, by G. H. P. Lichthardt.)

A NEW COLOR REACTION FOR ALOES.—A permanent pink color is obtained by the addition of a freshly made solution of potassium ferricyanide to a cold aqueous solution of Barbadoes aloes. This color is delicate enough to be discernible in dilutions of 1 part in 10,000. The strength of the test solution must be in proportion to the strength of the solution of aloes to be tested; if either is in excess, no coloration is obtained. It takes from five to fifteen minutes for the color to appear, but the reaction is materially hastened by quickly heating to boiling. Cape and Socotrine aloes do not give this reaction; instead, they show an emerald-green color not quite as delicate as the Barbadoes aloes, but sufficient to show 1 in 250 of Socotrine aloes, and is somewhat less delicate with Cape aloes. This reagent gives with commercial aloin a green color. Brought in contact with the extracts of cascara sagrada and rhubarb no reaction is given, showing that no color is produced by frangulin, frangulic acid, or chrysophanic acid. The color is destroyed by acids and small quantities of alkalies intensify the reaction and at the same time modify it by giving it a brown tint. (*The Analyst*, March, 1916, p. 75, by C. E. Stacy.)

THE ESTIMATION OF FREE ALKALI IN SOAP.—The customary

method for estimating the amount of free alkali in soaps is to dissolve the soap in alcohol, filter, and titrate the free alkali with standard acid. This method, however, has its disadvantages and is most unsatisfactory to most workers. The method recommended by the writer of this paper is practical and accurate. Briefly, it is based on the salting out of the soap from its aqueous solution with sodium sulphate and titrating the free caustic alkali with standard acid; silver is used as a spot indicator. Ten grammes of soap are placed into a wide-necked flask, 50 mils of distilled water are added, the flask lightly stoppered, and the contents heated until solution has been effected. Fifty mils of hot saturated solution of sodium sulphate are added and the precipitated soap separated and washed with a small quantity of sodium sulphate solution. The carefully gathered liquid is then titrated with $\frac{N}{10}$ sulphuric acid, using a 5 per cent. solution of silver nitrate as a spot indicator on a porcelain plate. A brown stain of silver oxide appears so long as free hydroxide is present; carbonates, silicates, etc., do not interfere in any respect with this reaction. Naturally, the silver nitrate and the sodium sulphate should be first tested for neutrality. The results are accurate and the method is delicate enough to permit of the determination of 0.01 per cent. of caustic alkali when added to a neutral soap. (*J. Soc. Chem. Ind.*, 1916, 35, 95–96, by F. H. Newington, through *The Analyst*, April, 1916.)

Alleged Occurrence of Hydrocarbon Oils in Mediterranean Fish-liver Oils.—An examination of a recent shipment of fish-liver oil to London revealed that it contained, or was supposed to contain, mineral oil. As much as 83 per cent. was shown to be unsaponifiable fat. In an endeavor to trace the source of this the investigator extracted the oils from the livers of fresh Mediterranean fish; the oil obtained from two distinct species, *Centrophorus granulosus* and *Scymnus lichia*, contained in the neighborhood of from 80 to 90 per cent. of an unsaponifiable liquid hydrocarbon having all the characteristics of mineral oil. The revelation of this fact is decidedly interesting, as it in a large measure supports the theory of the animal origin of petroleum.—(*Chem. Zeit.*, 1915, 39, 889; *Chem. Abstr.*, 1916, 10, 285, H. Mastbaum.)

Hexaiodine.—This easily remembered name—and that is the reason it is given to the medical profession, whose use of it will teach the laity how to ask for it direct from the distributer—is, chemically, hexamethylenetetramine monohydriodide. It is a white, odor-

less, crystalline powder, melting at 70° to 171° C., and is very soluble in water. It is said that the solutions have a slightly alkaline taste. It is also claimed to be well suited for the administration of iodine, since it can be administered in very large quantities without producing iodism. This may be so, but it naturally suggests that it probably contains much less iodine than other chemicals or combinations of this well-known and valuable element. It can be given hypodermically as well as by mouth. (*Chem. Abstr.*, 1916, 10, 369, through *Chemist and Druggist*, March, 1916.)

INDIAN OPIUM FOR MEDICINAL USE.—Some recent investigations undertaken at the Imperial Institute revealed the fact that it is possible to produce opium in India containing considerable morphine and entirely suitable in many ways for the manufacture of galenical preparations. Assays carried out on 102 samples revealed that the average amount of morphine in 51 samples was 10.26 per cent., calculated on dry opium. Twenty-one samples gave 7.5 per cent. of morphine. It was found that only 30 per cent. of the samples were so deficient in morphine content as to be unfit for medicinal use in the United Kingdom. The codeine content was also found to be considerable. In fact, Indian opium is now being very largely used in the United Kingdom for the making of codeine and morphine. In India it is the custom to mix the opium of commerce with more or less oil; this custom should be stopped, especially in that intended for chemical or medicinal use. It can be readily seen that such addition necessarily lowers the alkaloidal content; moreover, it also renders the opium unsuitable for the manufacture of pharmaceutical preparations. (*Bull. Imp. Inst.*, 1916, 13, 507, through the *Pharmaceutical Journal and Pharmacist*, March 25, 1916.)

THE TECHNICAL PRODUCTION OF HYDROGEN AND ITS INDUSTRIAL APPLICATION.[1]

By HARRY L. BARNITZ, PH.G.

Prior to the year 1907 little importance was given to the technical production of hydrogen gas. Since then, however, the application of hydrogen gas has been continuously and rapidly extended. With the development of the dirigible airship in Germany, it was imperative that hydrogen be cheap and easily obtainable in large quantities. Ac-

[1] Reprinted from *Metallurgical and Chemical Engineering*, vol. xiv, April 1, 1916.

cordingly the development of the airship may be considered the chief stimulus in the technical production of hydrogen. Germany, France and England have been the principal countries to first utilize the gas commercially. To Germany credit must be given for being the first, not only in developing its technical production, but also in extending its application. In the United States, hydrogen is continually increasing in importance in the industries, but prior to 1913 only little was used.

For the autogenous welding of steel, cast-iron, wrought iron, copper and aluminium and its alloys, hydrogen in combination with oxygen is finding continued increasing application. Hydrogen here presents the great advantages of wide applicability, cleanliness, and cheapness. Another use which is constantly extending is in the cutting of wrought iron and steel. The oxy-hydrogen flame will cut metal up to 24 inches in thickness. In the cutting process considerable excess of oxygen is required, whereas in the welding process a reducing gas mixture is used. The cuts are cleaner than those of a saw, and even in thick metal are only $\frac{1}{8}$ of an inch in width. The rapid extension of the cutting practice by the oxy-hydrogen process is due to its convenience, simplicity and cheapness. The oxy-hydrogen flame is also used for melting quartz and platinum, in lead burning, in the manufacture of synthetic jewels such as ruby and sapphire, and in many other technical processes.

In the manufacture of electric lamp filaments hydrogen finds further employment. Large quantities are used in the reduction of tungstic acid and in the sintering and fusing of the tungsten metal powder into rods.

Hydrogen produced by the silicon, aluminum and other similar processes costs from $5.20 to $6.85 per 1000 cubic feet. These processes have been displaced by practically three patented processes known as the contact-process (iron process), Rinker-Wölther process (oil process), and the Linde-Frank-Caro process (water gas process). The cost per 1000 cubic feet varies from 54 to 61 cents in these three processes. These figures are given on the basis of prices ruling in Germany. In plants of similar construction in the United States the cost of production is between 85 cents and $1 per 1000 cubic feet. In the United States only four plants of the newer type have so far been installed: two plants of 3530 cubic feet per hour, one of 10,600 cubic feet per hour, and one of 8000 cubic feet per hour. Over fifty electrolytic hydrogen plants have been installed in the United

States in the past five years, and the total amount of hydrogen now being generated by all processes per year in the United States is over 300,000,000 cubic feet.

The number of mechanical and chemical plants of the improved type erected in Europe up to the summer of 1914 (that is, up to the time when the war broke out) was 23, of a total capacity of 3530 to 10,600 cubic feet per hour. Three of these installations produce 200 to 880 cubic feet per hour. All of these plants in Germany, Russia, Austria, Sweden, Holland, Italy and England were installed by Germans. Other large installations were negotiated for, but the writer is unable to ascertain facts regarding them due to conditions at present in Europe. No doubt Germany has increased its hydrogen-producing plants; likewise England, France and the other countries. New installations were undoubtedly required for the increased number of airships and observation balloons which have been built during the war.

Modern Processes of the Technical Production of Hydrogen.

Linde-Frank-Caro Process—A Physical Liquefaction Water Gas Process.

In this process water gas, consisting almost solely of carbonic oxide (CO) and hydrogen, is cooled and compressed until the carbonic oxide is liquefied, while the hydrogen still remains gaseous and can be drawn off. The apparatus consists essentially of a water gas plant and a plant for the separation of the hydrogen from the carbonic oxide gas.

The water gas is produced in the usual way by passing steam through incandescent coke, whereby the steam is decomposed, its oxygen forming carbonic oxide with the carbon of the coke, while its hydrogen remains free. Water gas, on the average, consists of hydrogen 50 per cent., carbonic oxide 40 per cent., carbonic acid 4 per cent., nitrogen 5.5 per cent., methane 0.5 per cent., with smaller proportions of oxygen, sulphuretted hydrogen, and carbon bisulphide.

The hydrogen is separated from the rest of the gases by compression and cooling. The boiling-point of hydrogen, −253° C., is much lower than that of the other constituents, that of carbonic oxide being −192° C., and that of nitrogen −192° C. On cooling compressed water gas to the hydrogen are liquefied air, −193° C., all of the constituents except the hydrogen are liquefied. The hydrogen

thus easily separated in the gaseous state is of a high degree of purity.

Before this separation by cooling is attempted the water gas undergoes preliminary treatment for the extraction of carbonic acid, which, if not removed, would block the narrow tubes of the rectifying apparatus. The removal of the carbonic acid gas is effected for the most part by compressing the water gas, in contact with cold water, up to a pressure of about 12 atmospheres. At high pressure water absorbs carbonic acid more easily than at atmospheric pressure, and hence the quantity of water required for absorption is reduced. The small residue of carbonic acid still remaining in the water gas is extracted by passing the latter through caustic soda.

This method of compressing water gas and cooling it by liquid air produces hydrogen 97 to 98 per cent. pure. The residue consists of about 1 per cent. each of carbonic oxide and nitrogen. Sulphur, dust and moisture are absent from the gas. The hydrogen leaves the apparatus under a pressure of 25 atmospheres, which is a considerable saving of power when cylinders have to be filled with gas under pressure. Two to four men can operate a plant, depending on its size. The plant is kept in continuous operation for about a week; it is then advisable to shut down the hydrogen separating section in order that all the worn tubes may be cleaned. A second unit of this section of the plant is kept in reserve for use while the first unit is being cleaned. To bring the entire plant into operation requires twenty to twenty-four hours.

The Contact Process—Known as the Lane or Iron and Steam Process.

This process depends upon the well-known property possessed by incandescent iron of decomposing steam which is passed over it. The oxygen of the steam combines with the iron and the hydrogen is liberated. In the practical working of the process reduced iron ore is used which has the advantage over ordinary metallic iron of having a larger active surface and caking or fluxing less readily when heated.

The manufacture of hydrogen by this process proceeds in alternating periods, in one of which oxidized iron is converted by a cheap reducing gas to spongy iron, and in the other period steam is passed over the spongy iron with liberation of hydrogen. The cycle of operations proceeds continuously.

The essentials for the process are, therefore, iron ore, reducing gas and steam. Water gas is used as the reducing gas, and thus the

plant required consists of a water gas installation and a special hydrogen apparatus.

The decomposition of the steam by the incandescent iron is effected in vertical iron retorts set in furnaces heated by producer gas. The resorts are charged with iron ore through the upper lids. Above the retorts are valves for regulating the passage through the retorts of steam and of reducing gas alternately and for taking off the hydrogen and the spent reducing gases. The latter, consisting chiefly of carbonic acid and steam, are either discharged into the open, through a shaft, or are passed in to the retort furnaces, where any unconsumed constituents are utilized in heating the retorts.

The hydrogen gas thus produced passes from the retorts to the purifying plant. The first section of the latter is a condenser packed with coke sprinkled with water. From this condenser the hydrogen goes into two purifying vessels, worked in series, for the extraction of sulphur and carbonic acid. The gas then passes to a gas-holder, from which it can be taken either for immediate use or to a compressing station, where it is filled into cylinders. The hydrogen finally obtained by this process has a specific gravity of 0.090 – 0.092; its purity is 97 to 98 per cent., the residue consisting of nitrogen, with 0.2 to 0.3 per cent. carbonic oxide; furthermore, since the gas was cooled by contact with water, it is saturated with water vapor.

A plant for producing 3500 cubic feet per hour requires four workmen for each shift. Skilled labor is not essential. The iron ore which is used in the process can be kept in the retorts in uninterrupted operation for about two or three months. For efficient service the plant must be worked continuously, since it requires fourteen to twenty-four hours to start up from the cold.

The Rinker-Wolter Process—A Chemical Process for the Decarburation of Oil.

This process is the result of a research which originally aimed at the production of an illuminating gas, but failing in this, a highly efficient hydrogen-producing process was developed which ranks in importance with the iron-steam and the contact process. It is this process which is now being used to a great extent by Germany and Russia in their aeronautical work, owing to the portability of the apparatus. Complete installations are set up on railway cars and carried from point to point as required. The plant takes up but little

space, and is more easily supervised than the two other processes described above.

The process is one in which gas oil is used which is heated to 1200° to 1400° C. and decomposed into its chief constituents, carbon and hydrogen. The plant comprises the special gas-making plant and purifiers. The gas-making plant consists of two producers which are charged with coke. There is a gas connection from the lower part of the first to the upper part of the second producer; near the furnace and clinkering doors of the producers are air inlets. These air inlets are fitted with valves having interlocking gears to prevent accidents arising from careless manipulation. The air required to raise the heat in the producers is forced through these inlets by a high-pressure blower.

When the producers have reached the requisite temperature, the blower is stopped and the blast valves closed. Oil is then pumped onto the coke in the first producer, through spraying nozzles which atomize it. It is converted into vapor by the hot coke and passes through the bed of hot coke in the second producer. In this way the vapor is converted into a permanent gas, which leaves the bottom of the second producer and enters an hydraulic main. When the air is in turn again blown in at the base of the producers in order to raise their temperature, the carbonaceous residue left by the oil on the coke is burnt and contributes towards the heating up of the producers. It requires one to one and a half minutes' blast to raise the producers to the proper temperature again. Thereupon oil is again introduced into the first producer.

The oil is preheated in order to render it sufficiently thin and mobile to pass through the spraying nozzle. For preheating the oil the exhaust steam from the turbine or engine used for driving the blower is utilized. Solid impurities are removed from the oil by pumping it from the storage tank through a filtering chamber.

The gas issuing from the second producer passes through a water seal in the hydraulic main, and there deposits the greater part of the sooty matter which is carried over mechanically. Clean water flows continuously into the hydraulic main, and the sooty water flows off and runs into a settling pit, having partitions which force the water to take a long and tortuous course in order to ensure the deposition of the solid matter.

The last two chambers of the settling pit are packed with coke, which acts as a filter and retains the last traces of impurities, so that

the water may be run thence direct into any sewer or river. Soot is the only by-product of this process; the oil contains 80–85 per cent. of carbon, of which the greater part is liberated; only a small proportion of carbon is found in the form of hydrocarbons and carbonic oxide in the crude hydrogen gas. Most of the liberated carbon is retained by the coke in the producers, and is later burnt by the air blast. A small proportion goes forward as soot in the gas, and is deposited in the hydraulic main and washer. The soot which collects in the settling pit when dried can be burnt under the boiler. The gas passes from the hydraulic main into a washer, where sprays of water remove the last traces of soot.

On leaving the washer the gas contains 6 to 8 per cent. of carbonic oxide and sulphuretted hydrogen. The latter is removed in a purifier charged with bog iron ore. The carbonic oxide is extracted by hot soda-lime in the following manner: The gas passes from the iron oxide purifier into thin-walled retorts, set in a furnace which keeps the soda-lime with which the resorts are charged at a temperature of about 300° C. At this temperature the soda-lime absorbs the carbonic oxide from the gas. The gas thus purified is cooled by passage through an atmospheric condenser and is then stored in a gas-holder. The purity of the gas is from 97 to 98 per cent., the residue being nitrogen. The specific gravity is 0.087 to 0.090.

The operation of the plant is not difficult, and requires only moderate supervision. The producers can be heated up for use in one to two hours, and can be operated continuously for a few hours at a time, or for days, weeks or even months.

An installation of this type may be either stationary or portable. The layout of a portable installation of this process, as now used by the governments of Germany and Russia, is as follows: The producers, with oil tank, oil pump, pre-heater and hydraulic main, are installed on one railway truck, and the purifying plant, including the washer and the final condenser, is arranged on a second truck. A gas-holder constructed of balloon-fabric is carried on a third truck. The gas then passes from this holder to a compressor, placed on a fourth truck, by which it is compressed into steel cylinders.

Production of Hydrogen by Electrolysis.

In this process water is decomposed into its constituent elements, oxygen and hydrogen, by the aid of the electric current. One of the first commercial plants of this type to be erected in the United States

was at Waverly, Newark, N. J., in 1911. The electrolytic generators, or cells, are of two types; the unit type is composed of an outer tank, which serves as the negative electrode, and a perforated inner tank made of special composition iron which serves as the positive electrode. The two electrodes are separated by means of a specially prepared asbestos diaphragm which divides the apparatus into two compartments. On top of the cover are the current terminals, two sight feed indicators and pressure equalizers, also a cup through which water is introduced into the cell from time to time.

As soon as the electric current is applied oxygen and hydrogen are seen to bubble through the indicators. The electrolyte is an aqueous solution of caustic potash or soda, which serves to make the water a good electrical conductor. In each cell about 1 gallon of water is decomposed per 24-hour day, producing 76.8 cubic feet of oxygen and 153.6 cubic feet of hydrogen. The hydrogen is liberated on the walls of the outer tank (negative electrode), while the oxygen forms on the walls of the inner tank (positive electrode). The oxygen is carried up through suitable means to the oxygen equalizer, where it bubbles through water and passes on to the oxygen off-take pipe; the hydrogen similarly passes through the hydrogen equalizer and thence to the hydrogen off-take pipe. Each cell produces per kilowatt hour, 8 cubic feet of hydrogen and 4 cubic feet of oxygen. The current required per cell is 400 ampères at 2 volts. The purity of the electrolytic hydrogen is 99.8 per cent. and the oxygen 99.6 per cent.

The cost of hydrogen by this process, disregarding the value of the evolved oxygen, is about ⅛ of a cent per cubic foot at a current cost of 1 cent per kilowatt-hour at the generator. For small or moderate size plants where low cost current is available the electrolytic process is preferable to any other for the production of hydrogen.

The attractive features of this process are: (1) the simplicity of operation; (2) the little attention required (not exceeding the cost of a few hours of one man's time per day); (3) cheap raw material (requires only 1 gallon of water to be added to each cell per day). The plant can be operated continuously for years without cleaning or overhauling; the process is clean and safe, and the cell produces gas as soon as the current is turned on.

Another variation of the unit type generator or cell is the bipolar generator recently placed upon the market.[2] This type of generator

is of the filter press type, but is not a modified filter press. While the form of this generator was early introduced in the art the bipolar type only resembles same in form. It is specifically designed for the electrolytic separation of water at the highest efficiency. This type of generator is to be commended where floor space is a consideration, as it is more compact than the unit type cell. The bipolar generator is made in two sizes. The 4×11 feet has a rated daily capacity of 1700 cubic feet of hydrogen and 850 cubic feet of oxygen. Size 5×15 feet has a rated 24-hour capacity of 7000 cubic feet of hydrogen and 3500 cubic feet of oxygen. The above capacities are based on the use of caustic potash as electrolyte. Purity of the hydrogen is 99.8 per cent. and oxygen 99.6 per cent. The generator may be operated twenty-four hours a day and 365 days in the year. The cost of the gases produced is about the same as in the unit type. The bipolar generator is as completely automatic as a high duty generator of this type can be made. Practically the only attention required in operation is in the maintenance of the water supply. Only part of one man's time is necessary.

Hydrogen in the Industries.

Hydrogen Employment in Quartz Glass.

Quartz glass, which has long been recognized as an important material in the manufacture of various articles employed in the chemical industry, was first produced in 1839 by Professor Gaudin. Some of his quartz tubes and elastic threads were exhibited at the Paris Exposition in 1878.

In 1889, Boys, who recognized the possibilities of this remarkable substance, also succeeded in making small tubes and other articles.

However, little progress was made in the development of the quartz-glass industry until 1900, when Heraeus and Achendstone succeeded in making clear rock crystal articles large enough for practical purposes. The raw material is washed quartz sand containing 95 per cent. silicic acid, which is melted by the oxy-hydrogen flames, and it is now possible to melt and to mold into almost any desired form as much as 50 pounds of quartz at a time.

One of the remarkable properties of the quartz glass produced by this process is its resistance to acids. Even boiling acids, with the exception of hydrofluoric and phosphoric, will not readily affect it.

[2] See *Metallurgical and Chemical Engineering*, vol. 14, p. 108.

Quartz has the advantage of having a very low coefficient of expansion, being about $^1/_{17}$ that of the best glass suitable for chemical utensils and apparatus. The manufacture of quartz glass in the United States is only of very recent date.

Hydrogen in Balloons and Dirigible Airships.

Hydrogen, on account of its very low density, has the greatest lifting power of all gases, and is therefore used for filling balloons. The amount which a balloon will carry up, *i.e.*, "its ascensional power," is the difference between the weight of the balloon itself with its contained hydrogen, and that of an equal volume of air. A litre of hydrogen gas has an ascensional force of 1.2 grammes. The specific gravity of 98 per cent. hydrogen is 0.087, which corresponds to a lifting power of 73.5 pounds per 1000 cubic feet. Pure hydrogen has a specific gravity of 0.07, which corresponds to a lifting power of 75 pounds per 1000 cubic feet.

Hydrogen for balloon purposes must be free from impurities that would injure the fabric, and should be dry. It is not necessary that the hydrogen be under pressure for inflating a balloon. It will readily inflate at atmospheric pressure.

Melting of Platinum.

In the melting of platinum the oxy-hydrogen burner is used exclusively. The temperature of the oxy-hydrogen is about 2100° C., whereas the melting point of platinum is 1755° C. The great advantage of this flame is that it contains no elements injurious to the platinum, such as carbon. Illuminating gas, which was formerly used instead of hydrogen, was detrimental to platinum. The operation is carried out by passing oxygen and hydrogen at high pressure through an especially constructed oxy-hydrogen torch. The author devised a torch for this work several years ago, and it is practically the only platinum melting torch (oxy-hydrogen) used to-day in the United States by platinum smelters. The melting is best accomplished in a lime crucible. Oxygen and hydrogen at a pressure of 1800 pounds per square inch in cylinders containing 100 and 200 cubic feet, with reducing valves and regulators, are used.

Production of the Synthetic Ruby and Sapphire.

Practically all of the beautiful minerals of the corundum family are now being produced synthetically. The ruby and sapphire are the more important.

Alumina being the base of those precious stones, it remains only for the chemist to add the proper oxide to obtain the required colors and to fuse them together in the oxy-hydrogen flame. The ruby, for example, contains 98 per cent. of pure alumina and about 2 per cent. of chromic oxide.

The materials used are of the purest. It is absolutely essential that the material be pure, as otherwise the product obtained will be faulty and the color will be poor.

At a temperature of 1000° C. the material is calcined in a large oven and removed and reduced to a fine powder. The fine powder is then placed in the magazine of the oxy-hydrogen burner and forced down on a receiving base below the flame. The work at this stage is very delicate and requires most careful attention. All conditions must be regulated with mathematical precision, the rate of flow of the Al_2O_3 powder, the rate and pressure of the gases and the quality of the flame (1900° C.). With conditions properly adjusted the stone at first appears as a little stalk not larger than a pin head, which gradually grows in the fire. This stalk, as it grows taller, is broadened out by the manipulation of the torch by a skilled operator so as to form a small cone with the point down. The desired size obtained, the operator shuts off the gases and allows the jewel to cool. It is then broken from the base and is ready for cutting.

Electrolytic oxygen and hydrogen are used exclusively in this industry on account of the exceedingly high degree of purity of the electrolytic gases.

Hydrogenation of Oils.

In connection with the fat industry a very extensive use for hydrogen has developed. By the introduction of hydrogen into fatty bodies and oils of low melting point these are converted into hard fats of higher melting point. In other words, oils which are composed of unsaturated acids, such as oleic acid and their esters, will combine with hydrogen in the presence of a suitable catalytic agent, forming a saturated compound:

$$C_{17}H_{33}COOH + H_2 \rightarrow C_{17}H_{35}COOH$$

oleic acid + hydrogen = stearic acid.

The hard fats have a greater market value for the manufacturer of soap, candles and oleomargarine. Fish oils, etc., lose their disagreeable odor in the hardening process. The application of hydrogen

in the fat industry has brought about a great advancement. The process worked out on the following lines is known as hydrogenation.

The addition of the hydrogen to the unsaturated hydrocarbon of the soft fats is accomplished by exposing the latter to hydrogen under pressure at high temperature in the presence of a contact agent such as a mixture of finely divided clay with metallic nickel, copper or iron. This mixture is sprayed into a container made of boiler plate under a pressure of 4 or more atmospheres, the pressure varying according to the method of working and the catalytic agent employed. Into the container from the opposite end is introduced a current of hydrogen, which at a temperature of about 150° C. readily combines with the oil or reduces the fatty acids. The hydrogen is added in excess in order to facilitate the conversion, but the surplus hydrogen, after being freed from oil particles, is returned to the storage tank.

The consumption of hydrogen varies according to the nature of the raw material and the hardness of the product. It is usually from 2870 to 4300 cubic feet per ton. The fatty product run-off from the pressure vessel is an emulsion of the fat with the contact substance. The latter, after separation by centrifuging, is used over again.

The contact substance, according to the patent of Leprince and Siececke (Dr. Norman) is finely divided nickel or copper; according to Fokin, it is platinum, and according to Paal, palladium. With the last two conversion is effected at ordinary or relatively low temperature and at an exceedingly low pressure. Wherever these two rare metals in suitable form are used, many improvements in the process have lately been introduced. It is absolutely necessary to use hydrogen of a high degree of purity, since slight impurities in the gas will render the contact substance inactive. In the hydrogenation of cotton seed oil, 1 per cent. of hydrogen by weight converts it into a fatty body of the consistency of lard. The product obtained is edible.

The Synthetic Production of Ammonia.

The discovery of the synthetic production of ammonia by Professor Haber, of Karlsruhe, a few years ago, promises a very extensive use for hydrogen. It is of immense importance because it forms the basis of the well-known fertilizer, sulphate ammonia. When hydrogen and nitrogen are heated to 200° C. in their combining proportions, under high pressure and in the presence of uranium

as a contact substance, they unite to form ammonia. About 6 per cent. of ammonia is produced, and by removing this a further conversion is effected. The yield can undoubtedly be greatly increased and the process accelerated by the selection of a possibly more suitable contact substance and the application of possibly more appropriate temperature and pressure.

BOOK REVIEWS.

THE MICROSCOPY OF VEGETABLE FOODS. With Special Reference to the Detection of Adulteration and the Diagnosis of Mixtures. By Andrew L. Winton, Ph.D., Formerly Chief of the United States Food and Drug Laboratory of Chicago. With the collaboration of Dr. Josef Moeller, head of the Pharmacognostical Institute of the University of Vienna, and Kate Barber Winton, Ph.D., formerly micro-analyst, United States Bureau of Chemistry. With 635 Illustrations. Second edition. New York: John Wiley and Sons, Inc.

The first edition of this work in 1906 was indeed welcome to micro-analysts in the United States. Those having charge of the examination of foods and food products are usually quite conversant with chemical methods, but, as a rule, are untrained in microscopical work. Outside of the instruction given in colleges of pharmacy there is very little special microscopical training given to analysts. The result is a large corps of partially trained analysts who cannot avail themselves of what the microscope might reveal in the examination of industrial products. Perhaps one of the stumbling-blocks to directors having charge of chemical courses is the fact that most of the books, dealing with microscopical study of technical products, show that a great amount of preparation and considerable skill are necessary in order that results may be obtained. It is considered self-evident in a university course that a student must devote a semester to crystallography and another semester to mineralogy before he can proceed intelligently and satisfactorily take up physical crystallography. On the other hand, when it comes to microscopical work he is expected to have about as much training as he does with the polariscope and refractometer. It is self-evident that in the microscopical study of technical products considerable time should be devoted to acquiring certain botanical principles and biological methods in order that microscopical studies of raw or manufactured

products shall yield far-reaching results. This work of Winton might well be used in all university courses where chemists are turned out. No part of their curriculum would train them better or stimulate them more than the studies outlined in this work. It, however, has been prepared rather with a view of assisting in the detection of adulterations and in the diagnosis of mixtures. It is a practical manual for the analyst to use in his laboratory. The authors have not only done a great amount of original work themselves, but have had a large experience in state and federal work.

"Since the publication of the first edition of this book, microscopical methods have come into more general use throughout the United States in the examination of human and cattle foods, and, as a consequence, certain fraudulent practices have been suppressed or much restricted."

"Additions have been made to the sections on wheat and flour, a complete revision of such parts of the chapter on oil seeds as treat on mustards, rapes, cruciferous weed seeds, and linseed, a description of the histology of alfalfa, with distinctions from red and alsike clover, a revision of the sections on pomes and drupes, with practical hints on the examination of almond pastes, jams, preserves, and other fruit products, and rewritten descriptions of the cucurbitaceous fruits used as foods and adulterants."

"The application of the microscopy of foods is by no means limited to the detection of adulteration and the identification of unknown materials. The miller, the brewer, the oil presser, the feed manufacturer, the canner, and the coffee and spice grinder should be conversant with the structure as well as the chemical composition of their raw materials, and the student in the school of technology should follow both lines of study in order that he may be prepared to attack the complicated problems of the industries."

This work consists of ten parts, as follows:

Part I. Preliminary: Equipment, Methods, and General Principles.

Part II. Grain: Its Products and Impurities: Flour and Meal: Cereals: Weed Seeds: Fungus Impurities.

Part III. Oil Seeds and Oil Cakes: Cruciferous Seeds (Cruciferæ): Composite Oil Fruits (Compositæ): Miscellaneous Oil Seeds.

Part IV. Legumes.

Part V. Nuts: Palm Fruits (Palmæ): Walnuts (Juglandaceæ): Cup Nuts (Cupuliferæ): Miscellaneous Nuts.

Part VI. Fruit: Rosaceous Fruits (Rosaceæ): Saxifragaceous Fruits (Saxifragaceæ): Ericaceous Fruits (Ericaceæ): Citrus Fruits (Rutaceæ): Miscellaneous Fruits.

Part VII. Vegetables: Solanaceous Fruits (Solanaceæ): Tubers and Roots: Fungi.

Part VIII. Alkaloidal Products and Their Substitutes.

Part IX. Spices and Condiments: Rhizomes: Leaves: Flowers.

Part X. Commercial Starches.

It also contains a General Bibliography and a Glossary. Each article is handled with a detailed description of its microscopical structure, and this is usually supplemented with very beautiful and accurate drawings. There are also appended the principal diagnostic elements and a bibliography of important original papers. Where there are a number of related substances there is usually an analytical key which is helpful in practice.

The first edition has been very widely used and there are few laboratories or libraries in which it will not be found. The reviewer has used the first edition in his classes ever since it was issued, and has found it of great help to him and his students. The new edition, with the inclusion of the latest researches, will be greatly appreciated by microscopical analysts and students of the inner morphology of plants. H. K.

PLANT ANATOMY FROM THE STANDPOINT OF THE DEVELOPMENT AND FUNCTIONS OF THE TISSUES AND HANDBOOK OF MICRO-TECHNIC. By William Chase Stevens, Professor of Botany in the University of Kansas. Third edition, revised and enlarged, with 155 illustrations. Price, $2.50 net. P. Blakiston's Son & Co., Philadelphia, Pa.

This work of Professor Stevens is one of the most popular in the United States. For clearness of presentation of the subject and wealth of illustrative material on plant anatomy it is excellent. In this third edition there has been added a section on the phylogeny of the vascular bundle, and notable additions and improvements have been made to the chapters on reagents and processes and microchemistry of plant products.

The work includes chapters on: The Plant Cell; Differentiation of the Tissues; Secondary Increase in Thickness; Protection from Injuries and Loss of Water; The Plant Skeleton; The Absorption of Water and Minerals; Transport of Water and Soil Solutes; Intake and Distribution of Gases; Construction of the Plant's Food;

Transport of Foods Throughout the Plant; Storage of Food and Water; Secretion and Excretion; Reproduction; The Preparation of Sections; The Use of the Microscope; Reagents and Processes; Micro-chemistry of Plant Products; Detection of Adulterations in Foods and Drugs; and the work also includes a satisfactory index.

In his preface to the third edition the author calls attention to the growing interest in plant anatomy, and states that plant anatomy without the physiological and phylogenetic outlook is a soulless body, and that physiology lacking an anatomical basis possesses the evasiveness of a disembodied spirit. He believes that it is largely due to this change of viewpoint that accounts for the present-day interest in plant anatomy. While this may be true to some extent, the reviewer considers that it is in great part due to the very great practical interest in the subject. No phase of botanical work is complete unless accompanied with anatomical studies. This is even true in taxonomy, where it is used more than ever and is vitalizing the subject. H. K.

CURRENT LITERATURE.

On the Presence of Histidine-like Substances in the Pituitary Gland (Posterior Lobe).

Kossel gave the name histidine to a basic compound which he found among the cleavage products of sturine. This was in 1896. Subsequently this same compound was found among the cleavage products of complex proteins when these were subjected to acid hydrolysis or to tryptic digestion. Pauly found that a solution of histidine made alkaline with sodium carbonate gives a very beautiful diazo-reaction with diazobenzene sulfonic acid, which is deep cherry-red in dilutions of 1 : 20,000 and still markedly red in 1 : 100,000. Working with this solution and noting its behavior with the desiccated posterior lobe of the pituitary gland (consisting for the greater part of protein) prepared in the usual way, and a purified product soluble in water, the author of this paper draws the following conclusions:

1. It would seem that histidine (or some such compound or compounds) is contained in the desiccated posterior lobe of the pituitary gland.

2. These substances are probably in a more or less free state, or in some combination other than protein.

3. The compounds giving Pauly's reaction are probably not histidine, since Weidel's reaction, as modified by Fisher, and Knoop's reaction with bromine, were both negative.

4. Pauly's reaction is not a specific reaction for histidine, unless other compounds, such as tyrosine, *p*-oxyphenylethylamine, *B*-iminazolylethylamine, adrenalin, etc., are removed, but a general reaction for a class of compounds yet to be determined. (*Jour Amer. Chem. Society,* Jan., 1915, pp. 203–208, T. A. Aldrich.)

J. K. T.

Origin of the Buttermilk Cult.[1]

Many signs point to the existence of a buttermilk cult, a more sensible practice than most of those things which are called cults and fashions. No dairy lunch seems now to be able to do business without the aid of buttermilk, and it is being served in drug stores and in barrooms. Though the virtues and palatability of buttermilk have been known for ages, it is now being honored with the appreciation of more patrons than ever before. The buttermilk renaissance set in when the statement gained wide currency that sour milk was an aid to longevity. No doubt a great many persons were led to tasting buttermilk through reasons of vanity, but finding it good have got the habit. Every now and then there is a statement from some man of medicine that certain poisonous germs in our stomachs are destroyed by buttermilk and that perhaps the human family would be better off if it drank more buttermilk and sweet milk and less of many other beverages recommended as thirst quenchers.

It has been written that from immemorial days curdled milk in various forms has not only been a favorite article of diet among pastoral peoples, but has been credited with medicinal properties. Sour milk figured conspicuously in the Aryan system of medicine, and medical historians saw that that system antedated by centuries the theories and practices of Hippocrates, and by some writers it is maintained that Hippocrates acquired much of his medical wisdom either in the land of the Aryans or from members of that great division of the human family.

Milk was known to possess remarkable therapeutic properties, and it was prescribed fresh and in the form of curds and whey. It was highly recommended by ancient physicians in the case of intestinal disorders, and somewhat different remedial qualities were

[1] From the *Washington Star.*

ascribed to the milk of the cow, buffalo, goat, sheep, elephant, ass, and camel.

Pasteur made researches into the nature of fermentation, and it is said that the facts which he observed laid the foundation of biochemistry and bacteriology. He established what was then new, but what is now universally admitted, that in the matter of sour milk the chemical changes were effected by microörganisms, which cause the souring of milk by converting lactose or milk sugar into lactic acid, and produce analogous changes in other sugar-containing fluids.

What has come to be called the lactic acid theory was a step toward combating harmful bacteria with bacteria which in themselves were harmless and which were the natural enemies of the harmful bacteria.

Professor Metchnikoff, observing the high number of cases of long life among the peasantry of Bulgaria, made an investigation into their habits of living and, of course, among other things, found that they led a simple life and that an important article of their diet was curdled milk. In making a careful bacteriological analysis of this food three acid-forming organisms were isolated and one of these, established to be the most active of the three, was named *Bacillus bulgaricus*. Of this organism it has been written that it acted in counteracting the putrefactive changes set up in food products by other bacteria inhabiting the intestines. This result or decision was reached at the Pasteur Institute in Paris. The theory was reached that acid-forming organisms have the property of arresting the growth and activity of putrefactive alkaline ones, which cause a secondary fermentation with the production of poisonous changes, especially in the large intestine, and are absorbed.

The cleansing quality of sour milk is quite generally believed, and there has come to be a very large demand for buttermilk. It is worth noting that the buttermilk of commerce, the kind that a man gets when he walks up to a counter, is not "buttermilk," but "'butterless' milk," or skimmed milk which has been turned sour after the butterfat has been removed by a separator.

In the old days in the country, and to some extent in the country to-day, when the housewife or the maid churned butter not every bit of butterfat was removed. A good deal remained in the sour milk, and it was really buttermilk. Very little buttermilk of that kind is to be met with to-day, except in those families which still churn butter in the old way.

Tarantism and the Dancing Mania.[1]

Some people, in an effort to explain the modern dancing craze, have attempted to liken it to the remarkable dancing mania of the Middle Ages. Whether this is true or not, it is interesting to recall to mind the extensive outbreak of frenzied dancing which swept over a great part of Europe, particularly during and immediately after the tremendous epidemics of the Black Death. One of the earliest outbreaks to be completely described occurred in Aix-la-Chapelle, in 1374. The following strange spectacle was noted: Men and women "formed circles hand in hand, and, appearing to have lost control of their senses, continued dancing, regardless of the bystanders, for hours together in wild delirium, until at length they fell on the ground in a state of exhaustion. During the paroxysms the victims had hallucinations and some asserted that they felt that they had been immersed in a stream of blood, which obliged them to leap so high."

This extraordinary disease rapidly spread to many parts of Belgium, Holland, and Germany, where it was variously known as St. John's or St. Vitus' dance, according to the saint who was supposed to protect those afflicted. The malady was first considered the work of the devil, and the clergy were kept busy in their efforts to exorcise the evil one. That the disease was contagious was obvious, and the victims were prone to acute recurrences.

In Italy, where the disease later appeared, the learned Nicholas Perotti, in an account of the disorder, points out that no one had the least doubt that it was caused by the bite of the tarantula, a common ground spider, particularly plentiful in Apulia, a southern district in Italy. It is significant to note this early attempt to explain the malady on natural lines and subordinate the supernatural. From the insect the disease was given the name of *tarantism*. There was a general conviction that by music and dancing the poison of the tarantula was distributed throughout the whole body, and expelled in the sweat induced by the great exercise. Later on it became evident that even those who were not bitten contracted the disease. Inquisitive persons who came to see the unfortunates in their wild dances not infrequently stayed to participate. Relief could only be obtained by dancing until complete exhaustion was produced. The musicians, who in some instances were employed by the municipality for this special purpose, were under no circumstances allowed to

[1] *Science Conspectus*, vol. vii. 1916, p. 56.

stop, and substitutes had to be employed to relieve musicians who were themselves literally played out. As time went on it was noted that special kinds of music were very effective in bringing about the speediest cures. Music which permitted quick, lively dancing was most efficacious. A rapid music imported from Turkey soon became the standby and was given the name of tarantella, a term still used to describe a rapid whirling dance. There is an illustration in Athanasius Kircher's *Magnes sive de Arte Magnetica* (1643) which shows the tarantula, a map of that portion of Italy first affected, and a few stanzas of music labelled *Antidotum Tarantulæ*.

Tarantism was at its greatest height in Italy in the seventeenth century, long after the disease had disappeared in Germany. From this time the disease decreased, but has appeared on occasion among special sects, as for example the Convulsionnaires in France, the Holy Jumpers and the Barkers in England, the Holy Rollers in the United States.

Space prohibits a discussion of the disease itself, suffice to say that it is definitely known to be a nervous disorder akin to an imitative hysteria. It is doubtful if we shall ever see such widespread affections, but we may expect occasional outbursts of a similar character in connection with fervent revival services and the like. The poor physical and mental condition of the people in the past produced through poverty, plague, and other disasters undoubtedly played no small part in preparing their minds for the disorder of the Dancing Mania.

S. M. G.

Diabetic Foods.

Food Inspection Decision No. 160, recently issued by the United States Department of Agriculture, for the guidance of officials of the Department in enforcing the Food and Drugs Act, fixes a definite limit to the amount of starch and sugar that may be present in certain gluten products and diabetic foods, and also fixes the amount of nitrogen that must be present in certain of these products, and makes requirements as to moisture and other constituents. The decision covers ground gluten, gluten flour, self-raising gluten flour, and "diabetic" foods. The definitions and standards as stated in the Food Inspection Decision were recommended by the Joint Committee on Definitions and Standards, consisting of representatives of the

United States Department of Agriculture, the Association of American Dairy, Food, and Drug Officials, and the Association of Official Agricultural Chemists. These two associations have already adopted the definitions and standards.

Investigations by the officials in charge of the enforcement of the Food and Drugs Act have shown that various food products have been placed on the market from time to time that are recommended by the manufacturers for use by people suffering from diabetes. It is generally held that the foods best suited to persons suffering from diabetes are those which contain little or no starch and sugar. Some of the foods placed on the market and recommended by the manufacturers for use in diabetes have been found to contain nearly as much starch and sugar as ordinary products, so that they were of no more value in the treatment of diabetes than ordinary food products that could be purchased more cheaply. The diabetic patient can avoid ordinary food products that contain considerable quantities of starch and sugar, as the composition of these products are generally known. In the case of prepared foods advertised for use in diabetes, however, the patient may be misled into eating quantities of starch and sugar that might be positively injurious.

Hereafter such products should meet the requirements of Food Inspection Decision No. 160, which are as follows:

Ground gluten is the clean, sound product made from wheat flour by the almost complete removal of starch, and contains not more than ten per cent. of moisture, and, calculated on the water-free basis, not less than fourteen and two-tenths per cent. of nitrogen, not more than fifteen per cent. of nitrogen-free extract (using the protein factor 5.7), and not more than five and five-tenths per cent. of starch (as determined by the diastase method).

Gluten flour is the clean, sound product made from wheat flour by the removal of a large part of the starch, and contains not more than ten per cent. of moisture, and, calculated on the water-free basis, not less than seven and one-tenth per cent. of nitrogen, not more than fifty-six per cent. of nitrogen-free extract (using the protein factor 5 7), and not more than forty-four per cent. of starch (as determined by the diastase method).

Gluten flour, self-raising, is a gluten flour containing not more than ten per cent. of moisture, and leavening agents with or without salt.

"Diabetic" Food.—Although most foods may be suitable under certain conditions for the use of persons suffering from diabetes, the term "diabetic" as applied to food indicates a considerable lessening of the carbohydrates found in ordinary products of the same class, and this belief is fostered by many manufacturers on their labels and in their advertising literature.

A "diabetic" food contains not more than half as much glycogenic carbohydrates as the normal food of the same class. Any statement on the label which gives the impression that any single food in unlimited quantity is suitable for the diabetic patient is false and misleading.

The foregoing definitions and standards are adopted as a guide for the officials of the United States Department of Agriculture in enforcing the Food and Drugs Act.

Tartrazine as a Food Color.

A Food Inspection Decision has been issued by the United States Department of Agriculture permitting the use of tartrazine in coloring food products. Investigations have shown this color to be harmless and suitable for coloring foods. It is manufactured in large quantities in the United States. Seven other coal-tar dyes have been permitted in foods since the enactment of the Food and Drugs Act. Samples of all dyes certified by the manufacturers are examined in the Bureau of Chemistry and only such dyes permitted as are free from impurities and harmful substances.

Another decision has recently been issued making more stringent requirements in reference to the certification of coal-tar dyes when mixed with substances not coal-tar dyes. This decision provides that hereafter the manufacturer shall deposit with the Secretary of Agriculture a declaration that every package in which any such mixture is sold shall have a plain and conspicuous statement of the quantity or proportion of the certified dyes present in the mixture.

Drugs Below Standard.

Several Washington druggists have pleaded guilty to the charge of selling adulterated and misbranded tincture of iodine, according to a recent issue of the Service and Regulatory Announcements of the Bureau of Chemistry. Samples of tincture of iodine were purchased under authority of the Secretary of Agriculture from a number of

Washington druggists by inspectors of the Health Department. Analysis of the samples showed that many of them were deficient in some ingredients essential to a full-strength tincture. The Food and Drugs Act provides in substance that, when a drug is sold under a name (such as tincture of iodine) that is recognized in the United States Pharmacopœia, it must conform to the standard of strength, quality, or purity, as determined by the test laid down in the Pharmacopœia, or contain a statement on the label showing its true standard of strength, quality, or purity.

Tincture of iodine is used largely as an antiseptic in surgical operations. It is used also externally for local irritations and inflammations. Failure to prepare a tincture of standard strength is due usually to carelessness. A number of Washington druggists pleaded guilty to the charge of selling adulterated and misbranded tincture of iodine, and were fined $10 each by the court.

Sanitary Condition of Bottled Waters.

The Bureau of Chemistry for several years has been investigating the sanitary conditions in the production and distribution of bottled mineral and table waters which are offered for sale in interstate commerce and therefore subject to the Food and Drugs Act. It is recognized that the sale of bottled waters is dependent largely upon the belief by the public in the purity of the product. The Bureau has recently conferred with a large number of sanitary experts and bacteriologists regarding a desirable standard for judging the sanitary character of bottled waters. As a result of the investigational work and the above-mentioned conferences the Bureau believes that the tolerances established by the Public Health Service of the Treasury Department for waters served on interstate carriers are none too rigid for application to bottled waters sold in interstate commerce or imported from foreign countries. The Treasury Department standards are as follows:

1. The total number of bacteria developing on standard agar plates, incubated 24 hours at 37° C., shall not exceed 100 per cubic centimetre; *Provided,* That the estimate shall be made from not less than two plates, showing such numbers and distribution of colonies as to indicate that the estimate is reliable and accurate.

2. Not more than one out of five 10 c.c. portions of any sample examined shall show (by the method of the Public Health Service) the presence of organisms of the *Bacillus coli* group.

Thymol From Horsemint.

That the commercial production in this country of thymol from horsemint may be, under favorable circumstances, a profitable undertaking is indicated by the recent investigations of the United States Department of Agriculture, the results of which are published in Bulletin 372. Thymol is extensively used in medicine, and forms the basis of a number of important pharmaceutical compounds. In the past it has been imported from northern Europe, where it is manufactured from ajowan seed grown in northern India. Now that the European war has reduced these importations from over 18,000 pounds in 1914 to a little more than 2000 in 1915, it is believed that to some extent the demand can be supplied at home. For several years the Department of Agriculture has been conducting experiments with horsemint, which occurs as a common weed in many localities. These experiments have resulted in improving the plants by selection to a point which, it is said, warrants the use of horsemint for the commercial production of thymol.

Horsemint is found wild on light, sandy soils over the entire region from southern New York to Florida and westward to Wisconsin, Kansas, and Texas. It is probable that it will thrive under cultivation wherever it is found growing wild, but local economic conditions must be considered in determining whether or not its production would be profitable. The investigations of the Department of Agriculture indicate that by distilling the improved plants an average of 20 pounds of oil per acre may be obtained from first-year plantings, and that in succeeding years the yields should be at least 30 pounds per acre. The phenol content of this oil may be assumed to be about 70 per cent., almost all of which is thymol. The yield of thymol per acre of horsemint, therefore, should be, for the first year, a little less than 13 pounds, and for succeeding years a little less than 20 pounds. As the average price of thymol for a number of years has been about $2 a pound, the gross returns per acre from a horsemint plantation are estimated in the bulletin already mentioned at about $25.72 for the first year and $38.58 for each succeeding year.

It is more difficult to estimate with accuracy the cost of producing the thymol. In the opinion of the investigators, it is doubtful whether the profits from the industry will be sufficient to warrant any one in engaging in it unless the horsemint is grown in connection with other oil-yielding plants for which a distilling apparatus is required. In that event, of course, the entire cost of the distilling plant cannot be

charged against the thymol industry alone. For this reason, in the estimates of cost of production published in Bulletin 372, such items as land rent, taxes, depreciation, upkeep, and interest on the distilling plant have not been included. Excluding these items, it is believed that thymol can be produced at an approximate cost of $23 per acre the first year and $19 per acre thereafter. This figure includes the growing of the plants, fertilizer, cultivation, harvesting, and distilling. A plantation of horsemint will not have to be replanted oftener than once in five years, and under average conditions may continue to give a good yield for a still longer time. After the first year a material reduction can be made in the cost of fertilizers if the distilled herb is returned to the soil. These facts account for the reduction in the cost of production after the first year.

Color-Blindness.

It is only within a hundred years that color-blindness has been known to exist, and it is only comparatively recently that it has been known that women are never color-blind. Color-blindness is a characteristic which is inherited and passes on from one generation to another. If all the children of a color-blind father are girls, the trait remains dormant and reappears in one of every four male children of the next generation. It is, therefore, a sex link characteristic.

There are two types of complete color-bindness, each of which has to do with two groups of colors—red to blue and white and black. When the color-blind man has two important colors affected, he is said to be " dichromatic." When he is only color-blind and sees merely white and black, he is " monochromatic."

In the first of the above divisions are those who are red blind, green blind, and violet blind. Red blindness is most frequent. Its victims are really blind to both green and red, distinguishing only yellows and blues.

The seat of color vision is at the very centre of the retina. If the retina were painted with rings like a target, the bullseye would contain the visual points for green, the next outer ring would be red, the third blue, then white, and the outside ring would be black.

Some persons see colors imperfectly, but do not have true color-blindness. This defect is due to the use of tobacco. There is no known way of curing color-blindness.